



# NEWS

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**445 12<sup>th</sup> Street, S.W.**  
**Washington, D. C. 20554**

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NEWS MEDIA CONTACT  
Meribeth McCarrick (202) 418-0654

## **FCC RELEASES STAFF REPORT ON BROADBAND INTERNET ACCESS IN OECD COUNTRIES**

Washington, D.C. – The Federal Communications Commission's Office of Strategic Planning and Policy Analysis (OSP) and International Bureau (IB) today released a joint OSP/IB staff report entitled "Broadband Internet Access in OECD Countries: A Comparative Analysis."

This report reviews the broadband policy experiences of selected OECD countries, such as South Korea, Canada, Belgium, Denmark, Sweden, Switzerland, Japan, Germany, and the United Kingdom. The Organization for Economic Cooperation and Development (OECD) consists of 30 of the world's industrialized countries, including the United States.

The main conclusions of the staff report are that:

- In OECD countries, cable companies, rather than incumbent telecommunications carriers, have been the leaders in introducing broadband access services. This is especially true in countries such as Korea, Canada, Belgium, Sweden, and Japan.
- While telecommunications carriers in these countries did not lead the way to offering broadband access, they have often proven to be formidable competitors once they begin to offer DSL services. In 1999, 84 % of OECD broadband subscribers used cable modem services and 16 % used DSL. In 2000, the share held by cable modem users had slipped to 55%, with DSL users at 45%. In 2002, DSL took the lead with 54%, cable modems were at 41%, and other platforms at 3%. Across the OECD, DSL subscribers grew twice as fast as cable modem subscribers in the fourth quarter of 2002. This suggests that DSL providers, particularly incumbents, are not innovators but have the ability to compete vigorously and gain significant market share once they decide to enter a market.
- Sweden is the only country with a significant number of broadband users with access to a third platform other than cable modem services and DSL. Almost as many subscribers use Ethernet LANS (fiber networks within apartment buildings) as cable modems.
- In Japan and Denmark, new entrants took advantage of unbundling and line sharing rules to use the incumbent telco's lines to provide broadband. New entrants had a 44% market share in Denmark in 2001 (which since declined to 21% in 2002) and 60% market share in Japan.

In both countries, competition from cable is weak and unbundling requirements may play an important role in promoting broadband access.

The report will be incorporated in the dockets of the pending FCC broadband proceedings: *In the Matter of Appropriate Framework for Broadband Access to the Internet over Wireline Facilities*, CC Docket 02-33 , and *In the Matter of Inquiry Concerning High- Speed Access to the Internet Over Cable and Other Facilities*, CS Docket 02-52

This report represents the individual views of the authors and does not necessarily reflect the views of the FCC, any FCC commissioner, or other staff. The report was written by Sherille Ismail, Senior Counsel, Office of Strategic Planning and Policy Analysis, and Irene Wu, Assistant Chief, Regional and Industry Analysis Branch, Strategic Analysis and Negotiations Division, International Bureau.

The full text of the report is available at [www.fcc.gov/osp](http://www.fcc.gov/osp).

OSP contact: Sherille Ismail (202) 418-0429.

IB contact: Irene Wu (202) 418-1623.

A Staff Report of the Office of Strategic Planning and Policy Analysis and  
International Bureau\*  
October 2003

## “Broadband Internet Access in OECD Countries: A Comparative Analysis”

Sherille Ismail\*\*  
Senior Counsel  
Office of Strategic Planning and Policy Analysis

Irene Wu\*\*  
Assistant Chief  
Regional and Industry Analysis Branch  
Strategic Analysis and Negotiations Division  
International Bureau

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\* This report represents the individual views of the authors and does not necessarily reflect the views of the FCC, any FCC commissioner, or other staff.

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## **I. Introduction**

This paper reviews the broadband policy experiences of selected OECD countries.<sup>1</sup> These countries have adopted a variety of strategies to promote broadband growth.<sup>2</sup> Because many different strategies have been tried, it is possible to examine specific policy proposals (e.g., open access requirements, local loop unbundling, line sharing, duopoly competition) and evaluate which have been effective. Beyond the scope of this paper are other factors which might be influential such as population density, tax incentives, and subsidy programs.

In section II, we provide an overview of broadband internet access in selected OECD countries: South Korea, Canada, Belgium, Denmark, Sweden, the United States, Switzerland, Japan, Germany, and the United Kingdom. Each of the countries we discuss has taken a somewhat different approach to encouraging the development of broadband access. In the interest of brevity, we do not discuss all the approaches taken internationally. Other studies (including those listed in the “references” section at the end of this paper) comprehensively review the broadband experiences of all OECD members. We also do not discuss advanced broadband countries that do not belong to the OECD.

In section III, we offer a synopsis of the development of broadband in each of the selected OECD countries (excluding the U.S.). In each country, we identify key developments, including regulatory policy, and assess the state of competition.

Finally, in section IV, we offer our conclusions. We caution that any conclusions must be tentative because broadband growth is still in its very early stages, even in the most advanced markets. Moreover, market share among different broadband platforms, and within a platform, among incumbents and non-incumbents, is quite fluid.

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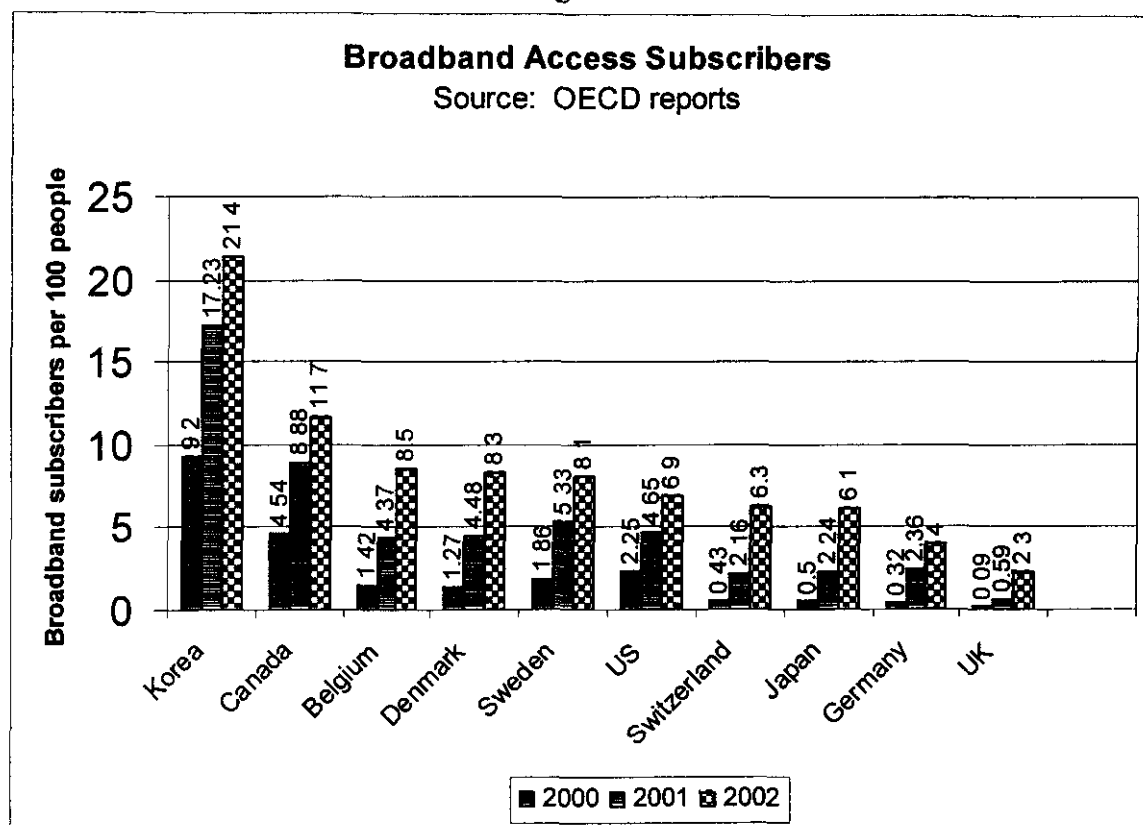
<sup>1</sup> OECD refers to the Organization for Economic Cooperation and Development, which consists of 30 of the world’s industrialized countries, including the United States. For more information, please see [www.oecd.org/about](http://www.oecd.org/about).

<sup>2</sup> The OECD definition of broadband is at least 256 kbps downstream and at least 64 kbps upstream, which differs from the FCC definition of high-speed lines as faster than 200 kbps in at least one direction. OECD data on the U.S. conforms to the OECD definition, which, except as noted, is used throughout this paper.

## II. Overview of Broadband Access

### A. Subscribers for broadband access services, 2000-2002

Figure 1<sup>3</sup>



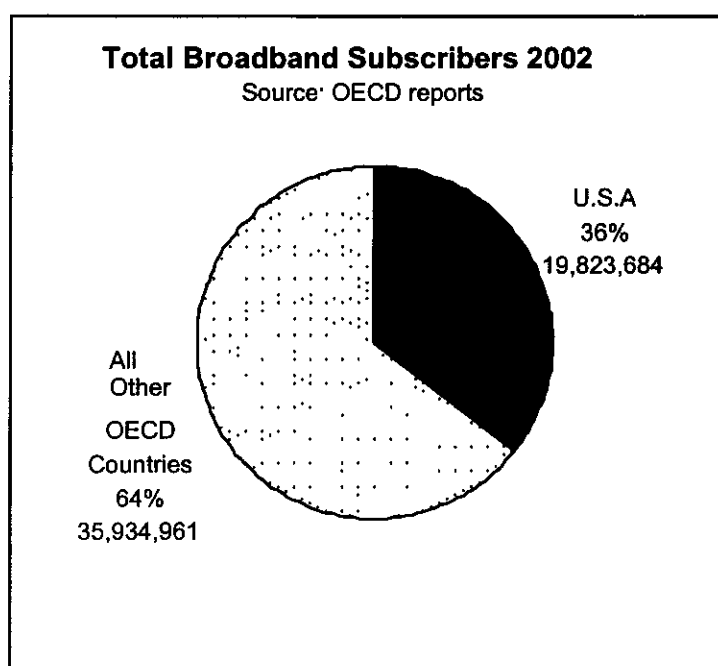
- “Subscribers per capita” is a widely used measure of the success of broadband policy in a country.<sup>4</sup> South Korea and Canada are far ahead of the rest of the world by this measure and have maintained their leading position in the rankings over the past three years. Other countries, such as Sweden, Belgium, and Denmark, have grown rapidly and overtaken the U.S. in the last two years.

<sup>3</sup> OECD, *The Development of Broadband Access in OECD Countries* (October 29, 2001) (“*Broadband Access*”) at table 3; OECD, *Broadband Access for Business* (December 4, 2002) (“*Broadband Access for Business*”) at table 2a; OECD, *Broadband Over Cable Television Networks* (unpublished draft, version May 9, 2003) (“*Broadband Over Cable Television*”) at table 4.

<sup>4</sup> An alternative indicator is deployment, i.e., the availability of broadband services. This data is harder to obtain and often less reliable. Some deployment information is included in the country by country synopses in section III.

- The total number of broadband subscribers in all OECD countries in December 2002 was 55 million. This number has grown from just over 30 million in 2001 to over 40 million in June 2002. Worldwide, there were over 62 million subscribers at the end of 2002.
- The broadband market is still in its early stages of growth. For comparison purposes, there are 150 million dial-up Internet users, 400 million mobile phone users, and over 500 million wireline subscribers in OECD countries.

**Figure 2<sup>5</sup>**



- In terms of total subscribers, however, the U.S. leads the world with close to 20 million subscribers for all broadband services. This represents more than one-third of the subscribers in all OECD countries (see chart). For comparison purposes, the U.S. has about 280 million people, which is about 25% of the population of all OECD countries.

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<sup>5</sup> *Broadband Over Cable Television* at table 4

## B. Broadband use—by access platform<sup>6</sup>

**Broadband Subscribers in Selected OECD Countries, December 2002<sup>7</sup>**

December 2002	DSL subscribers	Cable subscribers	Other subscribers	Total subscribers	Subscribers per 100
South Korea	6,386,646	3,701,708	39,959	10,128,313	21.4
Canada	1,642,554	2,008,566	-	3,651,120	11.7
Belgium	517,000	326,181	25,813	868,994	8.5
Denmark	307,055	133,003	5,784	445,842	8.3
Sweden	424,000	153,700	142,500	720,000	8.1
U.S. <sup>8</sup>	6,595,532	11,300,000	1,928,152	19,823,684	6.9
Switzerland	195,220	260,000		445,220	6.3
Japan	5,645,728	1,954,000	206,189	7,805,917	6.1
Germany	3,195,000	56,845	70,000	3,321,845	4.0
U.K.	590,000	779,319	2,000	1,371,319	2.3
OECD <sup>9</sup>	30,058,261	23,075,208	2,625,176	55,758,645	4.9

- The number of DSL subscribers exceeds the number of cable modem subscribers in South Korea, Belgium, Denmark, Sweden, Japan, and Germany. In the U.S., Canada, Switzerland, and U.K., however, cable modem use is higher.

<sup>6</sup> In this section, we treat all DSL subscribers alike, whether they purchase broadband access as: (1) an integrated package from the incumbent telecommunications carrier; (2) an integrated package from a competitor who may have acquired the lines through local loop unbundling, line sharing, or at wholesale rates (also known as bit stream access in Europe). See OECD, *Developments in Local Loop Unbundling* (2003) at 6-8. In the country-by-country analysis section, we include line sharing and wholesale DSL data, to the extent these services are available in the country. Cable modem service is not widely offered as a stand alone wholesale service in any of the countries in our sample.

<sup>7</sup> *Broadband Over Cable Television* at table 4.

<sup>8</sup> The numbers in this chart do not match exactly the numbers in FCC reports. FCC statistics show, for high speed services used primarily by residential subscribers:

Type of Technology	December 2002
ADSL	5,529,241
Coaxial Cable	11,342,512
All other technologies	485,168
Total	17,356,911

See FCC, *High-Speed Services for Internet Access Status as of December 31, 2002* (Industry Analysis and Technology Division, Wireline Competition Bureau, June 2003) at table 3. Another clarification concerns the users of "other" platforms (i.e., non-DSL, non-cable modem). As noted in the chart, the OECD reports that there are 1.9 million "other" subscribers in the United States. This is based on the FCC's number for June 2002, which includes commercial subscribers. Thus, the 1.9 million figure includes: about 1.2 million traditional wireline services, such as T1 and T3 lines or their symmetric DSL equivalents; about 0.5 million connections over optical fiber to the subscriber's premises, and about 0.2 million satellite and terrestrial fixed wireless connections. *Id.* at table 1.

<sup>9</sup> The total is for all OECD countries, including those not included in this chart.

- All OECD countries in our sample have at least one DSL and one cable provider of broadband services. In some countries, cable modem use may be constrained by the limited availability of cable modem access. As of 2001, the percentage of households passed by cable was only 27% in Japan and 50% in the United Kingdom. For all other countries in this sample, 65% or more households are passed by cable. In addition, in some countries, the cable operator is a weak competitor in providing broadband service because it is owned by the incumbent telecommunications carrier (e.g., Denmark) or was owned by the incumbent telco until recently (e.g., Sweden, Germany).<sup>10</sup>
- Sweden is one of the few countries with significant numbers of broadband users with access to a third platform (Ethernet LANS).<sup>11</sup> The growth of fiber to the home in Japan is also worth noting.
- In this sample of OECD countries, cable modem access dominated early offerings of broadband service, except in the case of Germany. However, in six cases – Korea, Belgium, Denmark, Sweden, Japan, and Germany – DSL subsequently grew to greater than 50% market share. [See graphs on page 20.] In some instances, such as Japan and Denmark, non-incumbents have a significant share of the DSL market.
- Cable modems accounted for 41% and DSL for 54% of the broadband access market in OECD countries at the end of 2002. The growth rate for DSL in 2002 was 83%, compared to the growth rate of 53% for cable modems. In the United States, however, cable modem service grew at a faster rate than DSL in 2002.

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<sup>10</sup> Incumbent telco's ownership share of cable operators declined from a high of 59% in 1998 to about 5% in 2003 *Broadband Over Cable Television* at 19 (describing the changes over time)

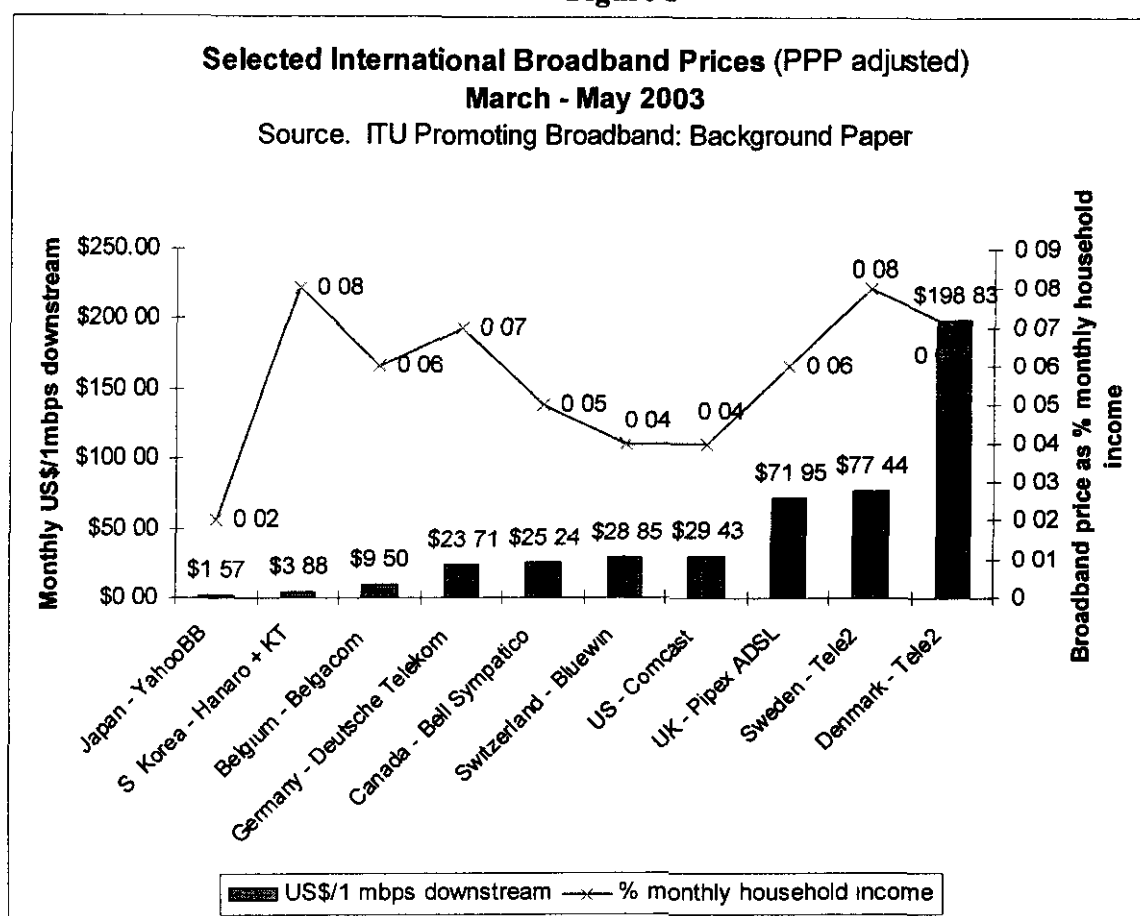
<sup>11</sup> "Ethernet LANS," refers to a common arrangement in Sweden where a local area network (LAN) on a residential property is linked to the Internet infrastructure through a city or regional fiber network. The residential LAN, which is not normally a fiber network, is based on Ethernet technology, and connects to individual homes on the property. See Sweden's Post and Telestyrelsen, "The Swedish Telecommunications Market First Half-Year 2002," footnote 26.



### C. Broadband Pricing

There is no simple way to compare the variety of broadband service packages available in different countries. We have chosen to calculate the monthly cost per 1 mpbs. While this method produces numbers that may be useful for the purpose of making broad comparisons, one limitation is that it requires an assumption that each additional mbps is equally valuable to the consumer. Economists may question this assumption, noting that experience in the U.S. has shown that there is no linear relationship between broadband capacity and price.

Figure 3<sup>12</sup>



<sup>12</sup> Prices for broadband packages are from March 2003, as cited in the ITU report, *Promoting Broadband: Background Paper*, except for Germany, which was drawn from Deutsche Telekom's website in May 2003. Purchasing power parity conversion factors (2001) are from the World Bank, *World Development Indicators*, an on-line resource, accessed in May 2003. GDP and household data (2002 or most recently available) are from *ITU Telecommunications Indicators*, also an on-line resource, accessed May 2003.

- The broadband prices above are generally those offered by the largest provider in each market, though not necessarily the least expensive service package available in each market. The prices are adjusted for purchasing power parity to even out the price differences among comparable goods and services across countries.<sup>13</sup>
- In markets such as Japan and Korea where very high capacity broadband service packages are commonplace, the price per mbps can be very low. Japan's YahooBB package offers 12 mbps downstream/1 mbps upstream for \$19 (PPP). Korea's Hanaro offers 8mbps downstream/8 kbps upstream for \$31 (PPP).
- As noted in the chart, Comcast offers a rate of \$29 (PPP) per month per mbps.<sup>14</sup> Many countries (e.g., Japan, S. Korea, Belgium, Germany, Canada, and Switzerland) have service at lower rates. Other countries, such as Sweden and Denmark, have higher rates. There does not appear to be a correlation between lower rates and higher numbers of broadband subscribers per capita. More research is needed to determine the role of price as a factor affecting consumer decisions to subscribe.
- The line on the graph tracks how much the broadband service charge is as a percentage of monthly household income. Within this sample, Americans are spending a relatively small percentage – 0.04% of their household income - on broadband. Swedes and Koreans appear to have the highest willingness to spend – up to 0.08% of monthly household income. The Japanese may be spending the least – 0.02%. Consumer willingness to spend may be a factor that affects broadband subscriber rates.

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<sup>13</sup> Where indicated, prices given are adjusted for purchasing power parity (PPP). Understanding factors that affect development levels in different countries require that measures usually calculated in national currencies be converted into a common accounting unit, in this case the U.S. dollar. PPP conversions establish purchasing power equivalence, where one dollar purchases the same quantity of goods and services in all countries, enabling more reliable comparisons across countries free of exchange rate distortions. For further information, see "What's Your Money Worth?" by Sultan Ahmad, World Bank, [www.worldbank.org/data/ppp/index.htm](http://www.worldbank.org/data/ppp/index.htm)

It is sometimes asserted in public policy debates that there is a relationship between broadband and narrowband subscriber levels. To fully explore this question it is necessary to examine, at a minimum, the following factors: broadband and narrowband prices, the rate structures for broadband and dial-up services, income levels, and deployment.<sup>15</sup> In this paper we discuss two of these factors. We suggest the need for further research that looks at all of the issues.

First, we address whether broadband take-up rates will be higher in countries where there is a smaller price differential between broadband and narrowband prices. The argument is that consumers have little incentive to switch to broadband if they must pay a lot more for it than they do for dial-up access, but will be more willing to switch to broadband if the additional cost is not much higher. Is this argument supported by the data in our sample?

The chart on the next page shows the price difference between broadband and 20 hours of dial-up Internet service, and between broadband and 40 hours of dial-up Internet service. The chart reveals that:

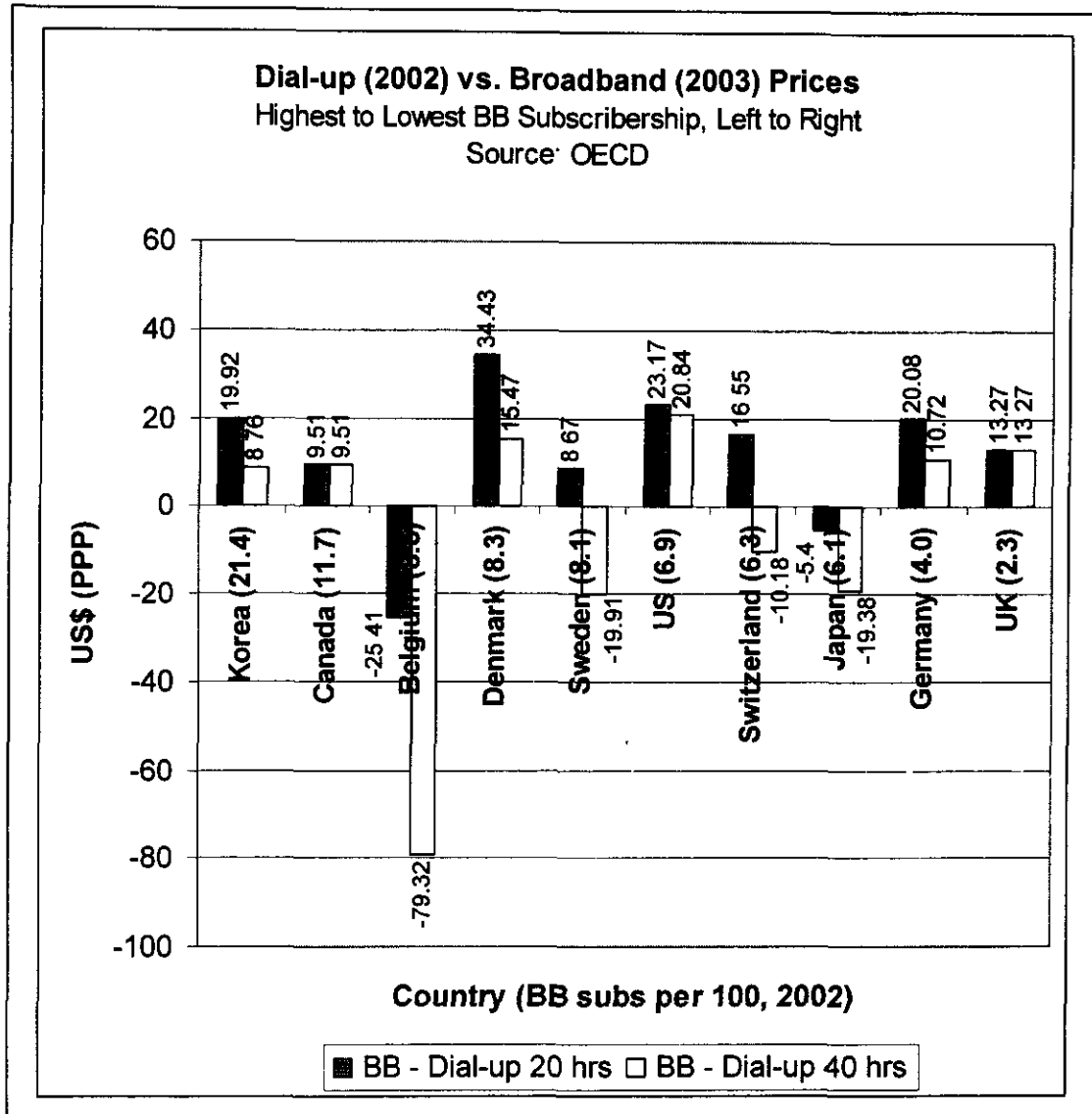
- Broadband is cheaper than 20 hours of dial-up Internet service in Belgium and Japan, which suggests that consumers in these countries would have a strong incentive to switch to broadband. Belgium and Japan are ranked 3<sup>rd</sup> and 8<sup>th</sup> in this sample in terms of broadband subscribers per 100 people.
- Broadband is cheaper than 40 hours of dial-up Internet service in Belgium, Sweden, Switzerland, and Japan. They are ranked 3<sup>rd</sup>, 5<sup>th</sup>, 7<sup>th</sup>, and 8<sup>th</sup> in this sample in terms of broadband subscriber per 100 people. Consumers in these countries also would have a strong incentive to switch to broadband.

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<sup>14</sup> The \$29 figures reflects adjustments for purchasing power parity based on Comcast's actual rate of \$42.95 per month for 1 5 mbps service.

<sup>15</sup> In addition, a more granular analysis may also review the impact of relative pricing of broadband and dial-up services. For instance, even if both dial-up access and broadband access are flat-rated, the relative

Figure 4<sup>16</sup>



- In the UK, the country with the lowest broadband subscribership per capita in this sample, the price of broadband is 56% higher than 20 hours of dial-up Internet service. In Korea, the country with the highest broadband subscribership per capita in this sample, the price of broadband is 178% higher than 20 hours of dial-up Internet service. In these countries, the expectation would be that consumers have

demand for the services may depend on the relative levels of the flat rate. We do not discuss this issue.

<sup>16</sup> OECD, *Communications Outlook 2003* (September 2002) at table 6.2 and table 6.4; ITU, *Promoting Broadband Background Paper* (April 2003).

less incentive to switch to broadband. Yet, these countries include the highest and lowest broadband subscriber levels in our sample.

Thus, we note that while price is always a factor in demand for a service, this evidence suggests that other factors may also have a strong influence. For example, in some markets there may be technical hurdles faced by consumers wishing to subscribe that serve as a barrier. In other markets, broadband service speeds may be so much higher and, therefore, offer so many more applications than dial-up Internet service, that the two services may no longer be comparable. Under those circumstances, the relative prices of broadband and dial-up may not be the most important factor in a consumer's decision to subscribe to broadband. Further research is needed to clarify which factors have the most impact on consumer decisions to switch to broadband service.

Second, we also address whether broadband subscriber levels are influenced by differences in the rate structure for local telecommunications and dial-up Internet service. For instance, if a country has metered pricing for dial-up internet access and flat-rated pricing for broadband access, this suggests that dial-up users will face higher marginal costs of usage than broadband users. In such a case, heavy users of internet access may be more likely to choose broadband access over dial-up access. In contrast, if both forms of internet access are charged on a flat-rated basis, economic theory suggests that consumers would have less incentive to switch to broadband. What does the data show?

The chart below shows the underlying rate structure for local telephony, local telecom access for dial-up Internet service, and DSL.

Several countries, such as Belgium, Denmark, Sweden, Switzerland and Germany, have metered dial up access and unmetered broadband access. These countries have among the highest and lowest subscribership rates in the countries in our sample.

Korea and Canada both have unmetered telecom access for dial-up Internet service and broadband access, although Korea has metered local telephony rates. These two countries have the highest level of broadband subscribership in our sample.

Of the two countries with the lowest level of broadband subscribership, Germany has metered and the UK has unmetered telecom access for dial-up Internet service.

#### **Rate Structure for Dial-up Internet and DSL Service**

Source: OECD, 2003

	Broadband subscribers per 100	Local telephony rate structure	Unmetered telecom access for dial-up Internet?	Internet access pricing structure	DSL pricing structure
Korea	21.4	Metered	Yes	Metered	Flat
Canada	11.7	Unmetered	Yes	Flat	Flat
Belgium	8.5	Metered		Metered	Flat
Denmark	8.3	Metered		Metered	Flat
Sweden	8.1	Metered		Metered	Flat
U.S.	6.9	Metered/ Flat/Unmetered	Yes	Metered/ Flat*	Flat
Switzerland	6.3	Metered		Metered	Flat
Japan	6.1	Metered	Yes	Metered	Flat
Germany	4.0	Metered		Metered	Flat
U.K.	2.3	Metered	Yes	Metered/ Flat	Flat

\* Information provided by FCC.

Further research is needed to clarify whether rate structure has an impact on consumer decisions to switch to broadband service. In particular, research should focus on what happens in a particular market over time. Cross-market analyses may be less relevant on this issue.

### III. A synopsis of broadband competition in selected countries

The following is a brief discussion of the broadband growth and competition in the nine OECD countries in our sample.

A. **South Korea:** *Competitors' access to cable networks spurs early broadband deployment. Incumbent telco aggressively gains market share.*

When cable service began in 1995, the Korean government required structural separation of conduit and content. The two state-owned cable infrastructure owners – Powercomm and Korea Telecom were not permitted to offer services, but instead leased capacity to programmers. Therefore, new entrants to the broadband market, such as Thrunet in 1998 and Hanaro in 1999, initially leased cable capacity to reach their earliest customers. Subsequently, the structural separation rules in cable were relaxed. Incumbent telco Korea Telecom sold its cable infrastructure to cable service providers in 2000.

Hanaro, in addition to leasing cable capacity, also provides DSL services over its own facilities-based network. In 2002, 48% of Hanaro's revenues were from cable modems (1.5 million subscribers) and 44% from DSL (1.3 million subscribers). Thrunet, sold parts of the company in recent years and filed for bankruptcy in 2003.

Korea Telecom, the telecom incumbent, entered the broadband services market in 2000, in response to the challenge presented by companies like Hanaro, which had by then signed up more than a million customers. KT rapidly increased subscribership, reaching 2 million in 2001 and growing to more than 4 million customers in 2002.

In 2002, local loop unbundling rules went into effect.

In 2002, there were 6.3 million DSL subscribers (63%) and 3.7 million cable modem subscribers (37%).

*B. **Canada:** Cable operators led the way on broadband access. Cable “open access” required on the books but not yet implemented due to court challenges. DSL gains market share after slow start.*

As of 2002, broadband by DSL or cable is available in communities which account for 85% of the population. However, reflecting the large number of widely dispersed small communities in Canada, broadband is available in only 24% of Canada’s 1,281 communities.

Cable companies became global pioneers, offering cable modem services as early as 1996. Canadian cable companies pass 93% of all homes and have the potential to provide broadband access to 6 million homes. In 2002, 26% of Shaw cable subscribers and 21% of Rogers cable subscribers signed up for broadband access.

Incumbent telecommunications carriers, like Bell Canada, Telus, and Sasktel, also offered DSL services ahead of other countries. Sasktel, for instance, became the first carrier in the OECD to do so by offering DSL in November 1996.

Although the regulator has required local loop unbundling since 1997, alternative providers have used local loop unbundling to provide service primarily to business (not residential) customers. In 2003, Canadian regulators clarified rules requiring incumbents to offer DSL unbundling for carriers serving residential customers. Similarly, although cable open access has been required since 1999, legal challenges have delayed implementation of this rule. Some cable operators have voluntary agreements to provide ISPs access to their networks.

In 2002, there were 2 million cable modem subscribers (55%) and 1.6 million DSL subscribers (45%).



- C. **Belgium:** *Cable spurs incumbent telco to provide broadband. Offers 3-4 mbps, the best baseline speeds in Europe.*

In 1997, Telenet became one of the first cable companies in Europe to begin offering high speed Internet access. Other smaller cable companies followed suit in 1998 and 1999. In 1999, Belgacom, the incumbent telecommunications carrier responded by offering DSL services. Competition has been driven by the fact that almost 100% of Belgian household have access to cable services. Today, 98% of households also have access to DSL services, prices are low, and consumers have among the highest speeds of bandwidth availability in Europe. Cable companies are offering 4 mbps downstream and DSL companies are offering 3 mbps downstream.

Local loop unbundling has been required since 2000, but competitive providers have been unable to gain any share of the broadband access market. Belgacom has 85% of all DSL subscribers, with the remaining 15% using an unaffiliated ISP who obtains broadband access from Belgacom at wholesale rates.

In 2002, there were 517 thousand DSL subscribers (59%), 326 thousand cable modem subscribers (38%), and 26 thousand other subscribers (3%).

- D. **Denmark:** *Unbundling local loop helps new entrants offer DSL, but incumbent regains lost market share.*

Since 1998, Denmark has required the incumbent telecommunications carrier to unbundle the local loop. Line sharing has been required since 2001. As a result, new entrants gained a market share of 44% of DSL lines in October 2001. By December, 2002, however, this percentage had declined to 21% after the incumbent captured market share by lowering prices. Even with the decline, Denmark has one of the highest percentages of DSL lines sold by new entrants.<sup>17</sup>

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<sup>17</sup> Competitive carriers market share of DSL lines in other European Union countries range from 0% to 4%

Sixty percent of households are passed by cable and half of these households are passed by upgraded cable television networks capable of providing broadband service. There are two large cable providers: TDC, which is owned by the incumbent telecommunications carrier, and TeliaSonera. Only 3% of TDC's potential customers have signed up for broadband access, compared to 13% of Telia Sonera's customers. Some have drawn comparisons between Denmark and Belgium, noting that the markets often have comparable subscriber levels for telecommunications and Internet. In the broadband market, while about 70% of the Danish population has access to DSL that provides at least 2 mbps downstream service, in Belgium higher speeds such as 4 mbps service are more widely available. One possible explanation is that, unlike in Denmark, the Belgian incumbent telecommunications carrier does not own any cable networks, and is better able to compete, e.g., by offering more capacity.

In 2002, there were 307 thousand DSL subscribers (69%), 133 thousand cable modem subscribers (30%), and 6 thousand other subscribers (1%).

*E. Sweden: Ethernet LANS start broadband competition. Competition from cable weaker because owned by telco.*

The leading technology for broadband access in 2000 was neither DSL nor cable modem access. Instead, Ethernet LANS connected more broadband customers than any other technology.<sup>18</sup> The leading provider, Bredbandsbolaget (B2) offers 10 mbps broadband access utilizing its own fiber optic network and switched Ethernet networks within large apartment buildings. By the end of 2001, however, DSL subscribers outnumbered subscribers from all other technologies.

TeliaSonera, the incumbent telecommunications carrier, provides an integrated DSL service to 75% of all DSL subscribers and has a substantial wholesale DSL business accounting for 24% of all DSL subscribers. TeliaSonera raised prices of

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<sup>18</sup> See, *supra* n.11, for definition of "Ethernet LANS "

broadband services to individual homes (which are not served by B2) by 30% in 2001. Local loop unbundling has been required since 2000 and line sharing since 2001. At the end of 2002, there were only 2282 unbundled loops, out of a total of seven million local loops. Competitors complain that TeliaSonera's local loop unbundling prices is higher than its DSL retail price.

About 65% of Swedish homes are passed by cable. TeliaSonera also, until recently, owned ComHem, the largest cable operator with over 60% of total cable subscribers. In 2002, only 2.7% of homes passed by ComHem were cable modem subscribers. By contrast, 15% of homes passed by UPC, the other large cable operator, were broadband access subscribers. In April 2003, the European Commission directed TeliaSonera to divest its cable networks.

In 2002, there were 424 thousand DSL subscribers (59%), 153 thousand cable modem subscribers (21%), and 142 thousand other subscribers (20%).

*F.      **Switzerland:** Neither unbundling nor open access required, nevertheless competition between cable modem and DSL has been strong.*

In 1995, Swisscom, the incumbent telecommunications carrier, acquired 32% of Cablecom, the largest cable operator with over half of all subscribers. In 1998, despite the opposition of Swisscom, Cablecom began to build its own broadband network. Swisscom subsequently sold its stake in Cablecom in 1999 and began to offer its own DSL services in 2000.

There is now strong competition between the two providers. In the fourth quarter of 2002, both Swisscom and Cablecom added 60,000 new subscribers. This is one of the highest per capita rates of growth in OECD countries.

Local loop unbundling was introduced in April 2003. Swisscom offers DSL at wholesale rates to other ISPs and an integrated DSL package directly to consumers

through its own ISP. Approximately 40% of DSL subscribers buy the service from ISPs unaffiliated with Swisscom.

In 2002, there were 260 thousand cable modem subscribers (57%) and 195 thousand DSL subscribers (43%).

*G.      **Japan:** *Unbundling local loop the primary method of competitor entry into broadband. Fiber networks are extensive.**

Until December 2000, NTT, the incumbent telecommunications carrier, was still marketing ISDN lines instead of developing a DSL offering. At that time, there were fewer than 70,000 DSL subscribers in Japan, two-thirds with new entrants. NTT was required to offer local loop unbundling and line-sharing (but not bit stream access). In December 2000, NTT was also required to unbundle fiber-to-the-home lines. Softbank Group, with its subsidiaries Yahoo-Japan and BB Technologies, took advantage of the unbundling rules to launch a new DSL offering in September 2001 that was hugely successful, and NTT also began to compete by cutting prices for its DSL services. By the end of 2001, the number of DSL subscribers had increased to 2.3 million. This number grew to 5.6 million at the end of 2002, and over 7 million by March 2003. NTT, the incumbent, has a market share of less than 40% of DSL lines. Non-incumbents, of which the largest is Yahoo BB (with 1.5 million customers), have a market share of around 60%.

Cable operators played a significant role in spurring broadband growth in Japan in the earlier years. In 2000, for instance, Jupiter had 141,000 cable modem subscribers, well ahead of the DSL numbers. Since then, however, growth in cable modem access has been far slower. From 2001 to 2002, for instance, cable modem subscribers grew from 1.3 million to 1.95 million. One factor may be that cable networks pass only one third of Japanese households, compared to the four-fifths coverage of DSL. Japanese cable companies, such as J-Com, however, drove competition by offering higher bandwidths of 8 mbps downstream and 2 mbps upstream—speeds which are now matched or exceeded by the leading DSL providers.

Fiber optic cable services, which offer 100 mbps access, are available to 43% of Japan and had more than 200,000 subscribers in 2002. A leading company is USEN.

In 2002, there were 5.6 million DSL subscribers (72%), 1.9 million cable modem subscribers ((25%), and 200 thousand other subscribers (3%).

*H.      **Germany**· Incumbent telco owned cable operator until 2003. Broadband slow to develop.*

Local loop unbundling has been required since 1996, and line sharing since 2001. New entrants, however, have leased only about 2% of local loops and are not significant providers of broadband access in competition with Deutsche Telecom. DT signed up 1.6 million customers in 2001, but then raised its prices. New subscribers in 2002 were less than a million. A small number of subscribers [less than 6%] buy broadband access from DT and choose an unaffiliated ISP. DT does not offer DSL at wholesale rates to unaffiliated ISPs.

Although 86% of German households are passed by cable networks, cable modem service is available only to around 260,000 households, and less than 60,000 are subscribers. More than 98% of broadband access subscribers use DSL services, and less than 2% use cable modem services. These low numbers can be explained in part by the fact that DT, until recently, owned the cable backbone networks and had little incentive to develop cable modem services. In March 2003, DT had sold its majority ownership stakes in all the cable networks.

HanseNet Telekommunikation offers broadband access through its fiber optic network in Hamburg to about 60,000 customers. Although more than 860 fixed wireless licenses were awarded to 12 different operators, few subscribers have signed up.

In 2002, there were 3.1 million DSL subscribers (96%), 56 thousand cable modem subscribers (2%), and 70 thousand other subscribers (2%).

*I.      **United Kingdom:** Cable operators late to offering broadband service, telco also slow to act.*

Broadband access has developed slowly in the U.K., although cable operators and telecommunications carriers have had the longest experience with infrastructure competition of any OECD country. Cable operators focused more on offering telephony and digital television services than cable modem services.

Cable operators, primarily NTL and Telewest, began offering cable modem services in 1999 and 2000. Cable passes about 50% of UK homes as of March 2003.

BT, the incumbent telecommunications carrier did not offer DSL services until May 2001, making the UK among the last major developed countries to have DSL. Although local loop unbundling is required, fewer than 2000 lines were unbundled in 2002. BT has a significant wholesale DSL business, amounting to 49% of all subscribers in March 2003. Sub-broadband services, i.e., cable modem access at 128 kbps, are popular to a greater degree than in other OECD countries.

As of March 2003 about 57% of the population has access to broadband either through DSL or cable modem service. About 25% can choose between either DSL or cable modem service.

In 2002, there were 779 thousand cable modem subscribers (57%) and 590 thousand DSL subscribers (43%).

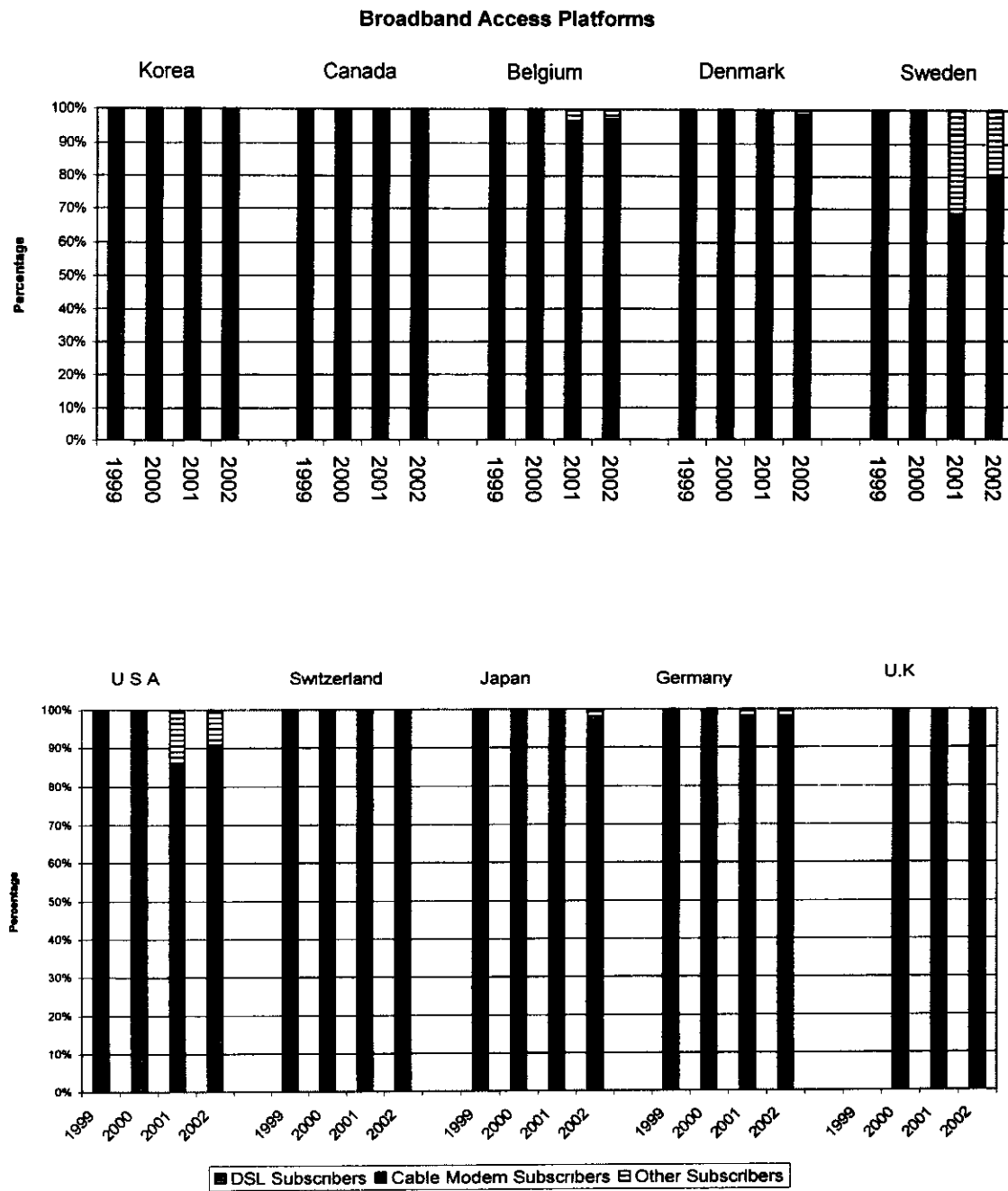
#### IV. Conclusions

- Cable companies, rather than incumbent telecommunications carriers, have been the leaders in introducing broadband access services to OECD countries. This is true in markets such as Korea, Canada, and Belgium, where cable networks are extensive and cable companies are historically separate from telecommunications companies. However, it is also the case in Japan, where only one-third of households are passed by cable and in Sweden, where only 40% of cable subscribers do not belong to the incumbent telco-owned cable operation.
- Once broadband access service has been introduced and proven to be a viable business, incumbent telecommunications carriers have responded by introducing DSL services that provided strong competition to the cable modem services. In many countries, the resulting “duopoly competition” has been effective in generating rapid take-up of broadband. This pattern has occurred in Canada, Belgium, Switzerland, and the United Kingdom, among other countries.
- Sweden is the only country where the main competitors were not cable modem services and DSL. Instead, operators of fiber networks within apartment building are the prime challengers to the telco and cable operators in the provision of broadband service.
- In two other countries, new entrants took advantage of unbundling and line sharing rules to use the incumbent telco’s lines to provide broadband. This is the case in Japan and Denmark. New entrants had a 44% market share in Denmark in 2001 (which since declined to 21% in 2002) and 60% market share in Japan. In both countries, competition from cable is weak. In Denmark, cable is less of a competitor than it might have been because it is owned by the incumbent carrier. In Japan, cable is hampered by the fact that it passes only one-third of all homes. Where competition from cable is weak, unbundling requirements may play an important role in promoting broadband access.

- Within this sample, only Canada requires its cable operators to provide open access for Internet services. In the short term, legal issues appear to make it difficult for firms to use open access to enter the broadband market, although some small Canadian cable operators are voluntarily leasing capacity to third party Internet service providers.
- In what appears to be an exceptional case, Korea had rules which required structural separation of cable infrastructure owners and cable service providers. These rules have now been eliminated. When they were in effect, however, they enabled new firms to use cable infrastructure capacity to provide quickly cable modem service and challenge the incumbent telecommunications operator. Another factor in Korea was competition among building owners who used broadband availability to attract residents.
- As demonstrated in the charts below, telecommunications carriers did not lead the way to offering broadband access, but they have often proven to be formidable competitors once they begin to offer DSL services. In South Korea, Belgium, and Sweden, incumbents have come from behind to take the lead. In Canada and Switzerland, incumbents are still behind but are gaining ground. In Denmark, the incumbent has regained market share it had lost to a new entrant. In 1999, 84 % of OECD broadband subscribers used cable modem services and 16 % used DSL. In 2000, the share held by cable modem users had slipped to 55%, with DSL users at 45%. In 2002, DSL took the lead with 54%, cable modems were at 41%, and other platforms at 3%. Across the OECD, DSL subscribers grew twice as fast as cable modem subscribers in the fourth quarter of 2002. This suggests that DSL providers, particularly incumbents, are not innovators but have the ability to compete vigorously and gain significant market share once they decide to enter a market.



Figure 6<sup>19</sup>



<sup>19</sup> Broadband Over Cable Television at table 4.

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